**Center Independent Research & Development: KSC IRAD**

# Distillation Brine Purification for Resource Recovery Applications

Completed Technology Project (2012 - 2013)

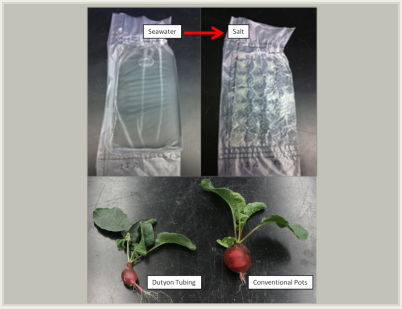
## Project Introduction

Wastewater processing systems for space generate residual brine that contains water and salts that could be recovered to reduce life support consumables. The project assessed the use of ion-exchange resins to selectively remove salts from wastewater treatment brines. The resins were then regenerated for additional use. The intention would be to generate a Na/K and Cl rich or purified brine that would then be processed into high value chemicals, such as acids, bases, and/or bleach.

Water comprises the majority of the daily mass requirements for crewed space missions. Used for drinking, food prep, or hygiene, water is one of the most critical life support elements. Reliable water recovery is paramount for long term space exploration either on the International Space Station (ISS) or beyond Earth's gravity well. Advances in water recovery have allowed longer mission durations and decreased launch costs. In order to visit or even habituate extraterrestrial bodies (Mars, Europa) further advances in water recovery are needed. Current environmental control and life support systems on the ISS are focused on air and water recovery. Wastewater is pretreated with chromic acid and then distilled. The pretreatment turns about 10% to 30% of the wastewater into unusable brine and makes further water recovery difficult. In addition, no chemicals are retrieved for reuse from the brine. If the wastewater were treated in bioreactors and then distilled or filtered, chemical pretreatment would not be needed and the remaining brine could serve as a resource for chemical and further water recovery. Development and application of brine tolerant ion-exchange resins could provide more efficient methods for retrieving elements and pure water from salt water, and provide feed stocks for commercial processes that generate bleach, HCl, and Na/KOH (e.g., Chlor-alkalai Process). If proven feasible, the combined benefits would reduce consumables and further close the water loop for future space exploration. and generate consumable chemicals, such as HCl, NaOH , KOH and sodium hypochlorite (bleach).

## Anticipated Benefits

NASA would benefit from reduced resupply of water, chemicals, and other consumables to the International Space Station, near-Earth object (NEO), and future surface missions, and save operation costs. This project could demonstrate an increased level of autonomy for future space mission, e.g., surface settings and benefit In Situ Resource Utilization (ISRU) efforts to harvest local elements and water.



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## Organizational Responsibility

**Responsible Mission Directorate:**

Mission Support Directorate (MSD)

**Lead Center / Facility:**

Kennedy Space Center (KSC)

**Responsible Program:**

Center Independent Research & Development: KSC IRAD

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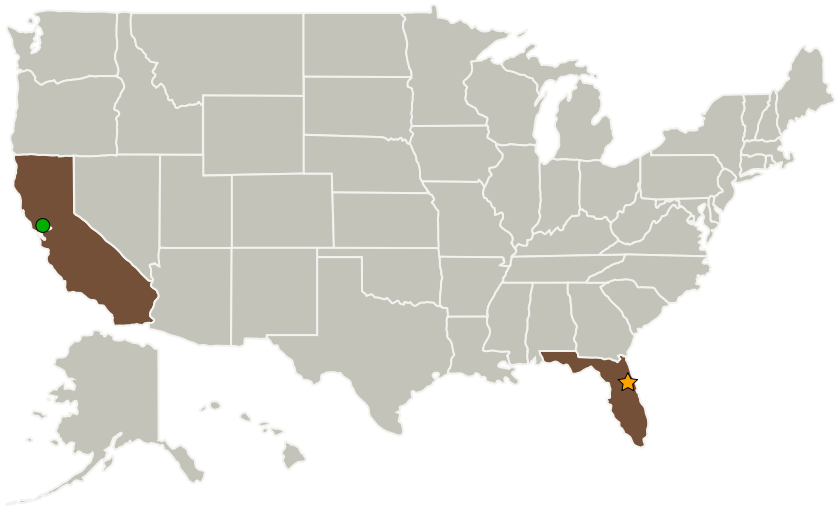
## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ★Kennedy Space Center(KSC) | Lead Organization | NASA Center | Kennedy Space Center, Florida |
| ●Ames Research Center(ARC) | Supporting Organization | NASA Center | Moffett Field, California |
| Florida Institute of Technology | Supporting Organization | Academia | Melbourne, Florida |
| QinetiQ North America(QNA) | Supporting Organization | Industry | |

| Primary U.S. Work Locations | |
|---|---|
| California | Florida |

## Project Management

**Program Manager:**
Barbara L Brown

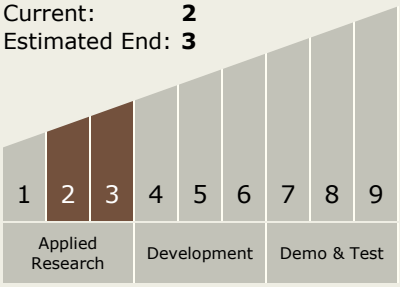
**Project Manager:**
Raymond M Wheeler

**Principal Investigator:**
Griffin M Lunn

**Co-Investigator:**
Griffin M Lunn

## Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**




## Technology Areas

**Primary:**

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.2 Water Recovery and Management

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## Images


**Distillation Brine Purification for Resource Recovery Application**
Distillation Brine Purification for Resource Recovery Applications *(https://techport.nasa.gov/image/2047)*